L Number	Hits	Search Text	DB	Time stamp
1	0	(retention with lifetime) and (baking or bake) and time and temperature and ferroelectric	EPO; JPO; DERWENT; IBM_TDB	2004/03/06 10:17
2	1	(retention with lifetime) and (baking or bake) and time and temperature and ferroelectric	USPAT; US-PGPUB	2004/03/06 10:24
3	9	(retention with lifetime) and time and temperature and ferroelectric	USPAT; US-PGPUB	2004/03/06 10:26
4	13	(retention with lifetime) and ferroelectric	USPAT; US-PGPUB	2004/03/06 10:26
5	4	((retention with lifetime) and ferroelectric) not ((retention with lifetime) and time and temperature and ferroelectric)	USPAT; US-PGPUB	2004/03/06 10:26

C:\APPS\EAST\Workspaces\09779123.wsp

L Number	Hits	Search Text	DB	Time stamp
1	2	(("6238933") or ("6541375")).PN.	USPAT; US-PGPUB	2004/03/05 16:16
2	1	ferroelectric and capacitor and memory and (retention with lifetime with test$3)	USPAT; US-PGPUB	2004/03/05 16:19
3	0	ferroelectric and capacitor and memory and (retention with lifetime with test$3)	EPO; JPO; DERWENT; IBM_TDB	2004/03/05 16:19
4	1	ferroelectric and capacitor and memory and (retention with test$3)	EPO; JPO; DERWENT; IBM_TDB	2004/03/05 16:21
5	0	(ferroelectric and capacitor and memory and (retention with test$3)) and bak$3	EPO; JPO; DERWENT; IBM_TDB	2004/03/05 16:21
6	0	(ferroelectric and capacitor and memory and (retention with test$3)) and temperature	EPO; JPO; DERWENT; IBM_TDB	2004/03/05 16:21
7	41	ferroelectric and capacitor and memory and (retention with test$3)	USPAT; US-PGPUB	2004/03/05 16:21
8	41	(ferroelectric and capacitor and memory and (retention with test$3)) and @ad<20030624	USPAT; US-PGPUB	2004/03/05 17:10
9	26	((ferroelectric and capacitor and memory and (retention with test$3)) and @ad<20030624) and temperature	USPAT; US-PGPUB	2004/03/05 16:22
10	8	(((ferroelectric and capacitor and memory and (retention with test$3)) and @ad<20030624) and temperature) and baking	USPAT; US-PGPUB	2004/03/05 17:09
11	83	retention and (baking or bake) and time and temperature and ferroelectric	USPAT; US-PGPUB	2004/03/05 17:24
12	72	(retention and (baking or bake) and time and temperature and ferroelectric) and state	USPAT; US-PGPUB	2004/03/05 17:10
13	72	((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624	USPAT; US-PGPUB	2004/03/05 17:10
14	43	(((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624) and (test or testing)	USPAT; US-PGPUB	2004/03/05 17:19
15	35	((((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624) and (test or testing)) not ((ferroelectric and capacitor and memory and (retention with test$3)) and @ad<20030624)	USPAT; US-PGPUB	2004/03/05 17:11
16	20	(((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624) and (determine or determining)	USPAT; US-PGPUB	2004/03/05 17:20
17	10	((((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624) and (determine or determining)) not (((((retention and (baking or bake) and time and temperature and ferroelectric) and state) and @ad<20030624) and (test or testing)) not ((ferroelectric and capacitor and memory and (retention with test$3)) and @ad<20030624))	USPAT; US-PGPUB	2004/03/05 17:20
18	0	retention and (baking or bake) and time and temperature and ferroelectric	EPO; JPO; DERWENT; IBM_TDB	2004/03/05 17:24

US-PAT-NO: 6008659

DOCUMENT-IDENTIFIER: US 6008659 A

TITLE: Method of measuring **retention**
performance and imprint
                           degradation of ferroelectric films

---------- KWIC ---------

Abstract Text - ABTX (1):
    A test method for characterizing **retention** performance,
both same state and
opposite state performance, of ferroelectric capacitors
includes the steps of
writing an original complementary data state into first and
second
ferroelectric capacitors after the ferroelectric capacitors
have been
initialized into an initial valid data state. The first
and second
ferroelectric capacitors are then subjected to **time and
temperature** stress.
The original complementary data state from the first and
second ferroelectric
capacitors is then read, and same state charge (Q.sub.SS)
information is
collected. An opposite complementary data state is then
written in the first
and second capacitors. After a short **time** interval,
possibly at an elevated
temperature, the opposite complementary data state from the
first and second
ferroelectric capacitors is read to gather opposite state
charge (Q.sub.OS)
information. The original complementary data state is then
written into the
first and second ferroelectric capacitors. The first and
second ferroelectric
capacitors are then subjected to further stress cycles,
after which the same
state and opposite state charge values are recorded. A
plot of the same state
charge (Q.sub.SS) and opposite state charge (Q.sub.OS)

versus log **time** can be
generated, which has great value for fully characterizing a
ferroelectric
capacitor and for predicting the performance of a
ferroelectric capacitor in a
memory circuit.

TITLE - TI (1):
    Method of measuring **retention** performance and imprint
degradation of
ferroelectric films

Parent Case Text - PCTX (1):
    This application is related to copending application
Ser. No. 08/616,856
filed on the same date as this application entitled "The
Use of Calcium and
Strontium Dopants to Improve **Retention** Performance in a PZT
Ferroelectric
Film", which is incorporated herein by this reference.

Brief Summary Text - BSTX (2):
    This invention relates generally to ferroelectric films
and ferroelectric
capacitors. More particularly, the present invention
relates to a measurement
method for characterizing the **retention** performance and
imprint degradation of
the ferroelectric film,·as well as other performance
aspects.

Brief Summary Text - BSTX (8):
    It is important to note that the peak voltage of the
pulse sequence 24 shown
in FIG. 2A is ideally two to three times the "coercive
voltage" associated with
the ferroelectric film under test. The "coercive voltage"
is shown as points
38 (negative coercive voltage -V.sub.C) and 40 (positive
coercive voltage
+V.sub.C) along the x-axis or voltage axis of the
hysteresis loop 36 plotted in
FIG. 3. Points 42 and 44 on hysteresis loop 36 define the
two stable states of

the ferroelectric film after an externally applied electric field has been
removed. Point 42 is generally referred to as an "up" polarization state, and
point 44 is generally referred to as a "down" polarization state. These two
points 42 and 44 can be arbitrarily defined as a logic one and a logic zero in
a one-transistor, one-capacitor ("1T-1C") ferroelectric memory cell, and are
compared against a reference level. In a two-transistor, two-capacitor
("2T-2C") ferroelectric memory cell (best seen in FIG. 7), the cell is
self-referencing. In this case, the two capacitors are always set in a
complementary data state, which means that one capacitor is at point 42 and the
other is at point 44. To read the memory, the two capacitors are compared to
one another to **determine** which capacitor is polarized up and which capacitor is
polarized down. For example, in reference to the capacitors of FIG. 7, a logic
one could be defined as capacitor 126 polarized up and capacitor 128 polarized
down, in which case a logic zero would be defined as capacitor 126 polarized
down and capacitor 128 polarized up.

Brief Summary Text - BSTX (11):
   A crucial property of nonvolatile semiconductor memories, and ferroelectric
memories in particular is **retention** in the absence of power. **Retention** is the
ability to maintain a given data state between the **time** the data state is
written and when it is subsequently read. A certain data state is written into
a ferroelectric capacitor, or, in the case of a two-transistor, two-capacitor
("2T-2C") memory cell, a complementary data state. After a specified period of
time, and at temperature, if desired, the data state is read to **determine**
whether or not the original data state has been retained in the memory cell.

Retention can be further characterized into an ability to maintain the same
state (same state="SS") data or charge (Q.sub.SS) and an ability to read the
opposite state data (opposite state="OS") or charge (Q.sub.OS) after
maintaining an original data state for an extended period of **time**. Failure to
maintain the same data state rarely occurs, and failures are usually related to
operation at elevated temperatures near the Curie point in which the
ferroelectric material tends to become paraelectric. A small Q.sub.OS charge
indicates the failure of a ferroelectric memory cell to read an opposite data
state. This failure mechanism is known as "imprint", and is frequently the
source of failure in a ferroelectric memory. Imprint is the inability to
maintain an opposite data state once an initial data state has been stored
under **time and temperature** stress, i.e. the original data state is preferred or
has been "imprinted" into the ferroelectric capacitor or film.

Brief Summary Text - BSTX (12):
    Prior art techniques for testing **retention in a ferroelectric** film or
capacitor included observing the ferroelectric material after a **time and
temperature** interval for the presence of a hysteresis loop, single pulse
testing, exclusively concentrating on the same state aspect of **retention,** one
capacitor tests, and other tests that generally did not emulate the
functionality of a ferroelectric capacitor in an actual memory circuit.
Further, these tests did not generate graphical predictions for charge loss
over **time**.

Brief Summary Text - BSTX (13):
    What is desired is a testing technique that can fully